

U.S. Department of Transportation  
Federal Aviation Administration

Subject: INFORMATION: Availability of All-Engine Maximum  
Continuous Thrust (MCT)

Date: July 31, 2000

From: Manager, Transport Airplane Directorate, Aircraft  
Certification Service, ANM-100

Reply to 00-113-1028  
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The purpose of this memorandum is to clarify part 25 requirements related to the availability of Maximum Continuous Thrust (MCT) with all engines operating.

A twin engine transport category airplane has been presented for type design approval with a proposed engine control system that precludes the attainment of Maximum Continuous Thrust (MCT) when both engines are operating. Under one-engine-inoperative conditions, MCT is available; however, with both engines operating the maximum non-time-limited thrust level obtainable would be restricted to less than two engines at MCT. The Transport Airplane Directorate's position is that an engine control system that does not allow MCT to be obtained with all engines operating is non-compliant with the airworthiness standards of 14 CFR 25 (part 25).

The inability to obtain MCT with all engines operating is a reduction in the level of safety inherent in part 25. Although part 25 does not have a specific requirement explicitly stating that the engine-inoperative MCT used to show compliance with the performance requirements of §§ 25.111, 25.121(c), and 25.123 must be obtainable with all engines operating, the current requirements are based on the assumption that all engine MCT would be twice that obtainable for a single engine MCT level. Under this relationship, additional safety margin is inherently provided for normal operations with all engines operating. This safety margin would be reduced if MCT is not obtainable with all engines operating.

The relationship between the one-engine-inoperative and all-engines-operating performance levels intended by part 25 was previously published in the preamble to Amendment 25-62 (52 FR 43152) where the FAA states, "Part 25 engine-out climb requirements not only define a level of safety for the engine-out condition but also define the all-engine performance level consisting of the engine-out requirement plus the added performance provided by the additional operating engine(s)." "[T]he all-engine level of safety is defined by the existing engine-out requirement. Infringing on this relationship would violate the intent of the regulations."

Part 25 does not have a separate all-engines-operating MCT performance requirement because, assuming that the same MCT thrust level (per engine) is available with all engines operating as with one engine inoperative, it was determined that such a requirement would never be more limiting than the one-engine-inoperative requirement. Part 4b of the Civil Air Regulations, the U.S. airworthiness requirements prior to part 25 of the Federal Aviation Regulations, did have a rate of climb requirement in the cruising configuration with all engines operating at maximum continuous power. This requirement, however, was not carried over to Special Civil Air Regulation No. SR-422, which introduced performance requirements for turbine-powered transport category airplanes. The preamble to SR-422 makes it clear that such a

requirement was unnecessary because “the establishment of minimum values of climb [for the all-engines-operating case]...has been found not to be critical.”

This determination that the all-engines-operating case would not be limiting is also consistent with the findings documented in the 1953 “Final Report of the Standing Committee on Performance,” an International Civil Aviation Organization committee tasked to develop recommendations for international standards for transport category airplanes. In the report, the committee concluded that only the dominant (i.e., limiting) cases needed to be addressed. The cases examined by the committee included all engines operating, one engine inoperative, and (for 3 and 4 engine airplanes) two engines inoperative. For the flight segments where MCT is the appropriate power setting, the committee concluded that the all-engines-operating case would never be the dominant case. As with the evolution of the part 25 performance requirements described in the preceding paragraph, this conclusion is based on the assumption that the same MCT thrust level (per engine) is available with all engines operating as with one engine inoperative.

More recently, an application for airworthiness approval was received in which the manufacturer proposed the first Automatic Takeoff Thrust Control System (ATTCS), which automatically increases the thrust on the operating engines if an engine fails during takeoff. Although there is an all-engines-operating takeoff distance requirement in part 25, there was not at that time an explicit requirement specifying any relationship between the takeoff thrust used for all engines operating, and that provided by the ATTCS with one engine inoperative. The all-engines-operating takeoff distance margin originally appeared in SR-422 “to ensure that an adequate margin of safety will exist for day-in and day-out operations,” not to allow for an all-engines-operating per-engine thrust level different than the one-engine-inoperative per-engine thrust level. Appendix I to part 25, introduced by Amendment 25-62 to provide the airworthiness requirements applicable to the installation of an ATTCS, contains a specific requirement relating the all-engines-operating takeoff thrust level to that which is set by the ATTCS with one engine inoperative.

In addition to the regulatory issues noted above, the TAD is concerned that restricting the capability to obtain MCT to the one-engine-inoperative condition treats MCT as an emergency rating. This approach to the use of MCT has been proposed in the past for economic reasons (engine warranties), but the FAA has not approved it. The airworthiness requirements do not recognize emergency ratings for fixed-wing aircraft. The intent of the requirement for a MCT rating is to always have available the highest thrust selected by the applicant and certified for continuous unrestricted operation.

In summary, to attain the level of safety intended by part 25, MCT must be available with all engines operating during all phases of flight. Aircraft Certification Office should ensure that their applicants understand the part 25 requirements regarding the availability of all-engine MCT. If you have any further questions on this subject, please have them contact Don Stimson. He can be reached at (425) 227-1129 or via e-mail at [Don.Stimson@faa.gov](mailto:Don.Stimson@faa.gov).

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